# UAS in Antarctica

- Additions of counts of predators on krill from vertical aerial images captured from the APH-22 hexacopter

Jefferson Hinke, Michael Goebel, Douglas Krause, Wayne Perryman

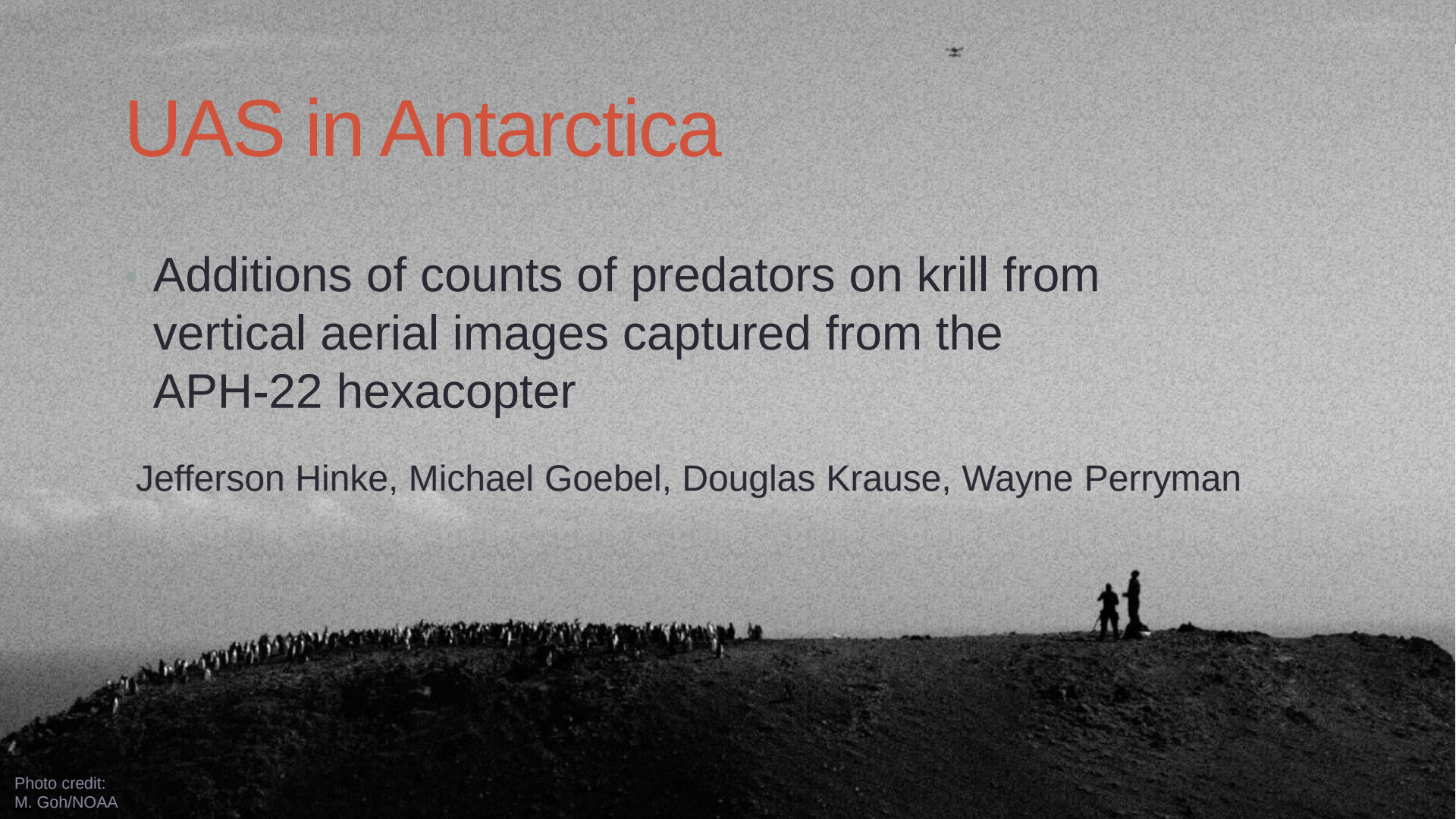


Photo credit:
M. Goh/NOAA

2010/11 Field Season Report
U.S. Antarctic Marine Living Resources Program

Chapter 10
NOAA-TM-NMFS-SWFSC-524

**Small Unmanned Aerial Systems for Estimating Abundance of Krill-Dependent Predators: a Feasibility Study with Preliminary Results**

Wayne Perryman, Michael E. Goebel, Nancy Ash, Don LeRoi, and Steve Gardner

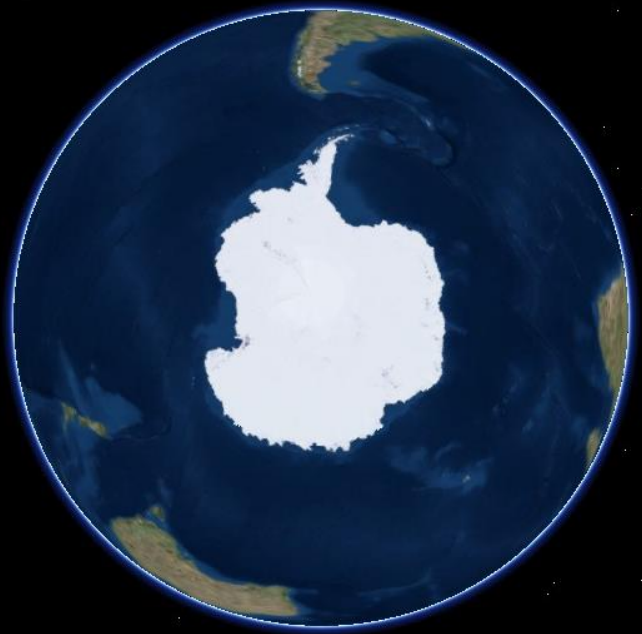
Polar Biol (2015) 38:619–630
DOI 10.1007/s00300-014-1625-4

ORIGINAL PAPER

# A small unmanned aerial system for estimating abundance and size of Antarctic predators

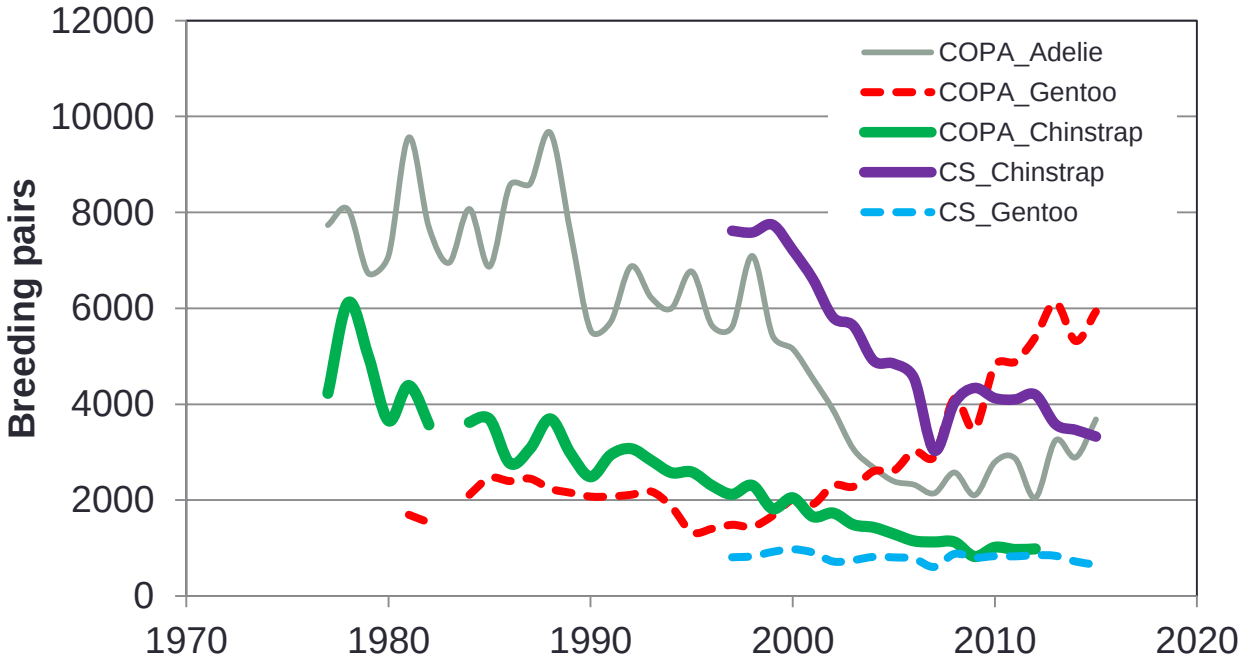
**Michael E. Goebel · Wayne L. Perryman · Jefferson T. Hinke · Douglas J. Krause · Nancy A. Hann · Steve Gardner · Donald J. LeRoi**

# Where



# The AERD conducts long-term research

## Census data a primary data set




# Eye-level ground counts can be challenging

Photo credit:
J Hinke/NOAA

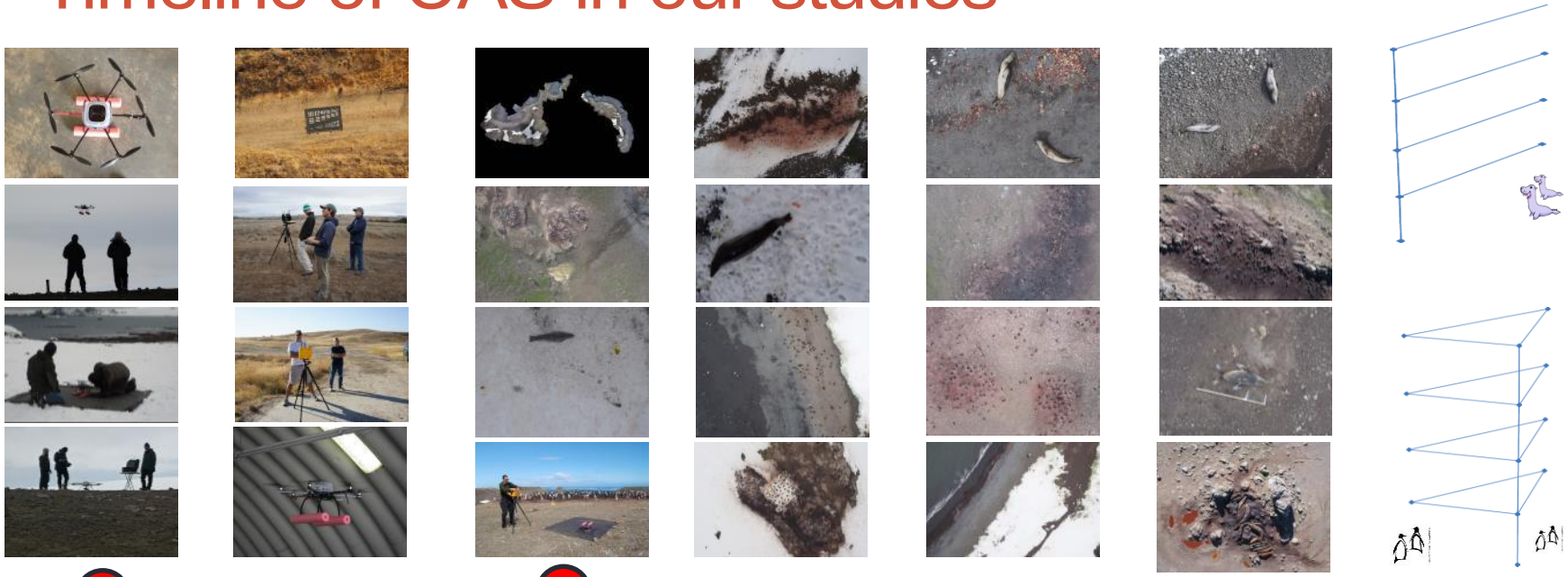
# Vertical images help

Photo credit:
NOAA

# Life-stages visible in images

Photo credit:
NOAA

# Timeline of UAS in our studies



**2010/11**
APH-22 R&D and 1st flights

**2011/12**
NOAA scientist pilot training and testing

**2012/13**
Census, photogrammetry mapping

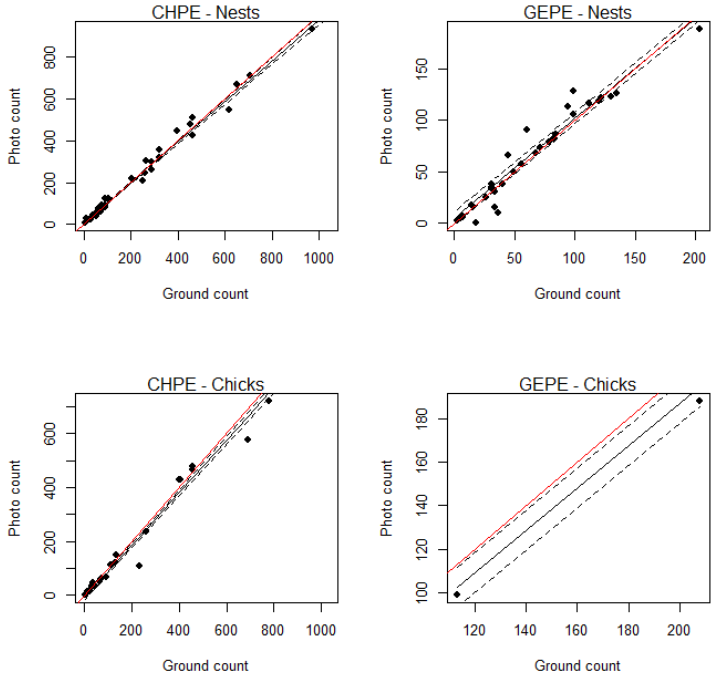
**2013/14**
Full season census, photogrammetry

**2014/15**
2 field sites, coastal mapping census, photogrammetry

**2015/16**
Census, photogrammetry, E. seals

**2016/17**
Add disturbance study

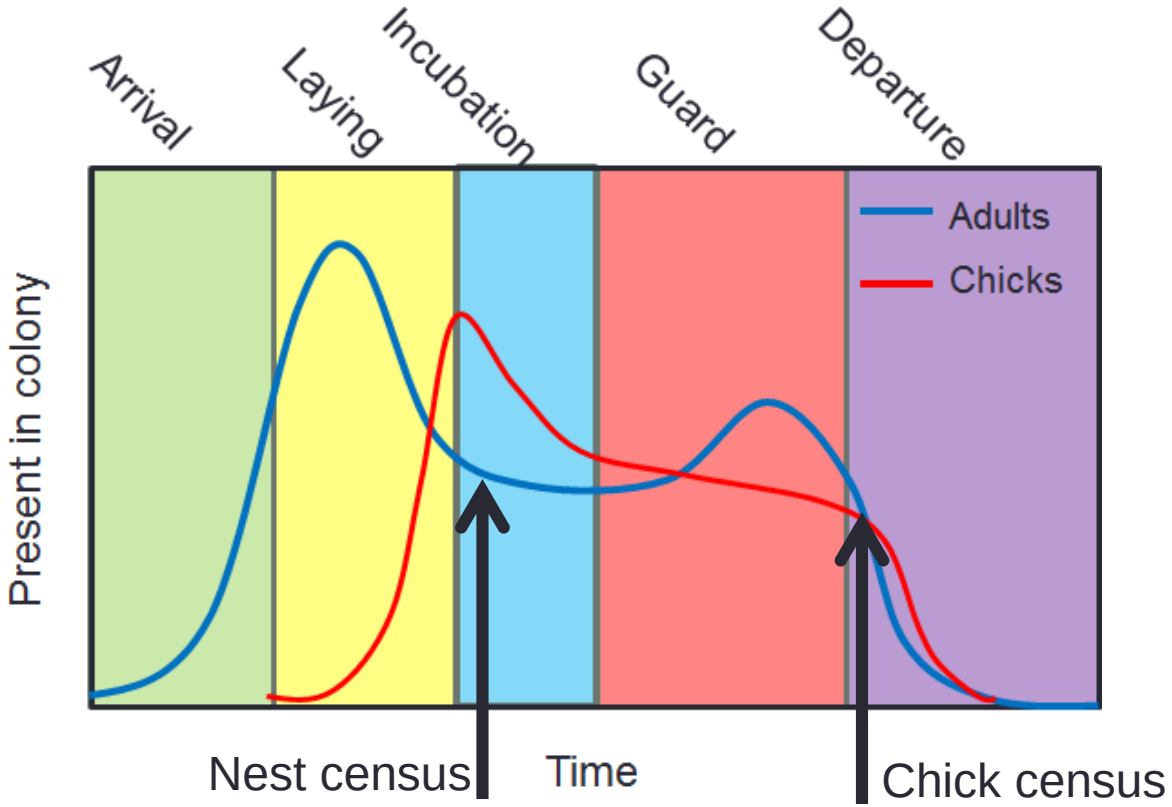
# Validation studies: 2012/13-2015/16



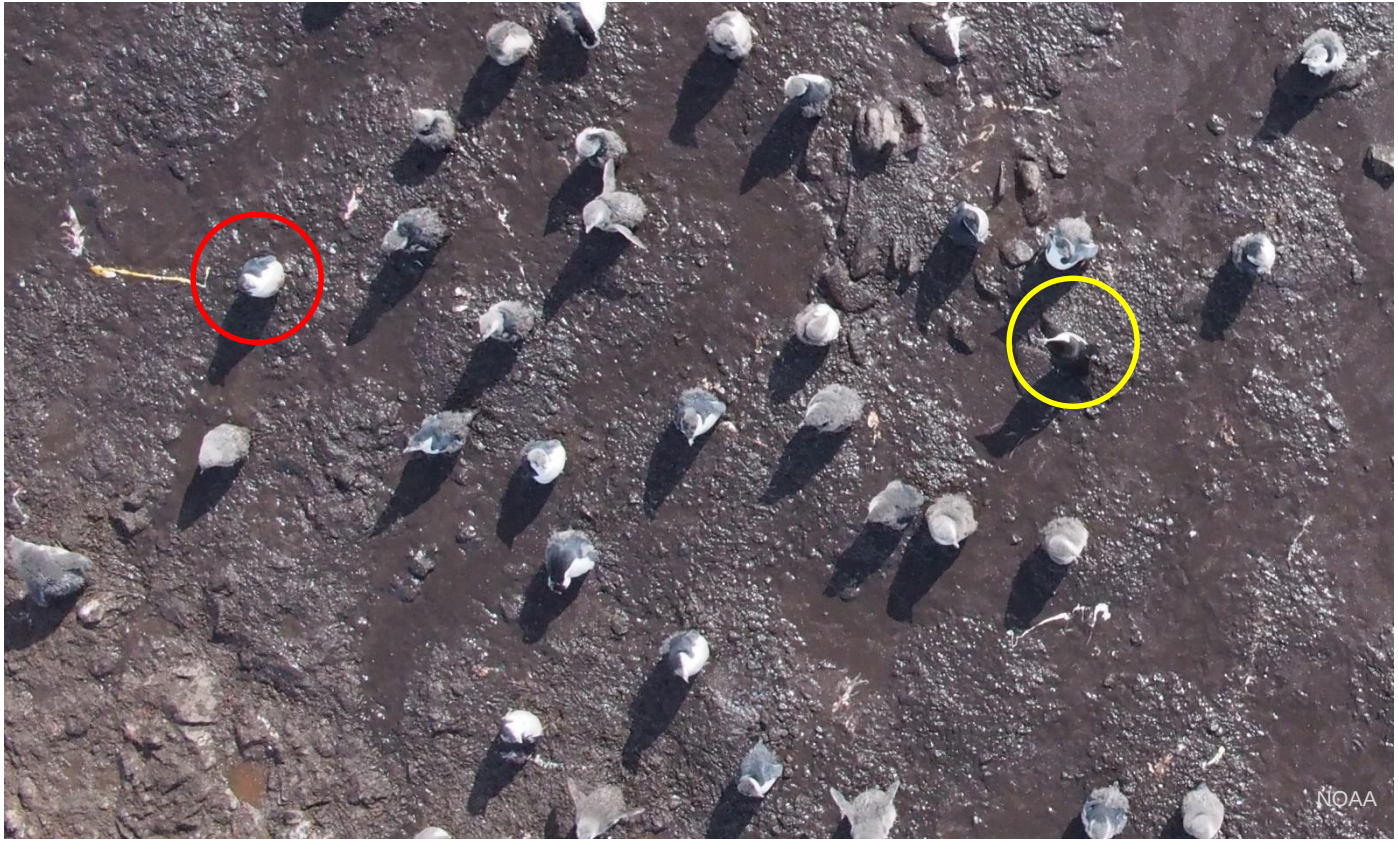

- Good correspondence for adults
- Slight undercount of chicks from aerial images

1:1 line  Model fit  Confidence interval

# Flight timing is critical

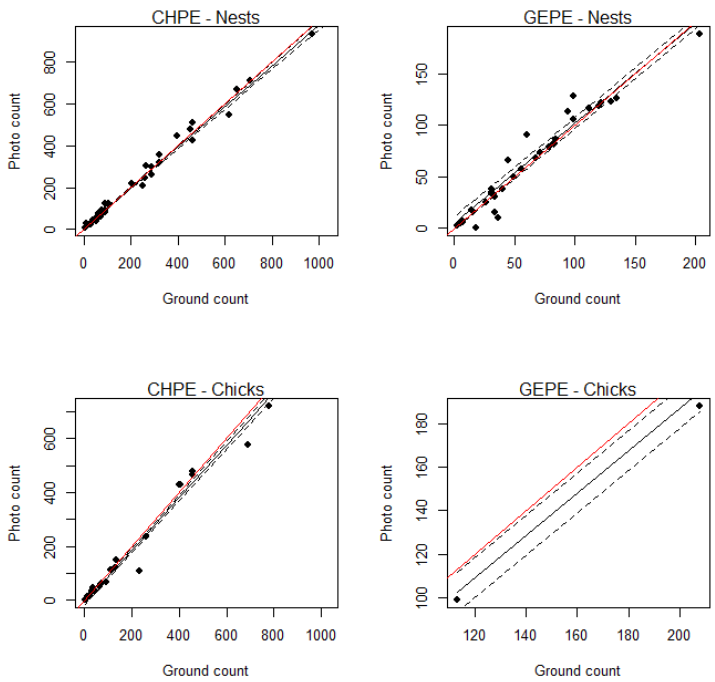


# Fluffy chicks become little adults



# Chicks move

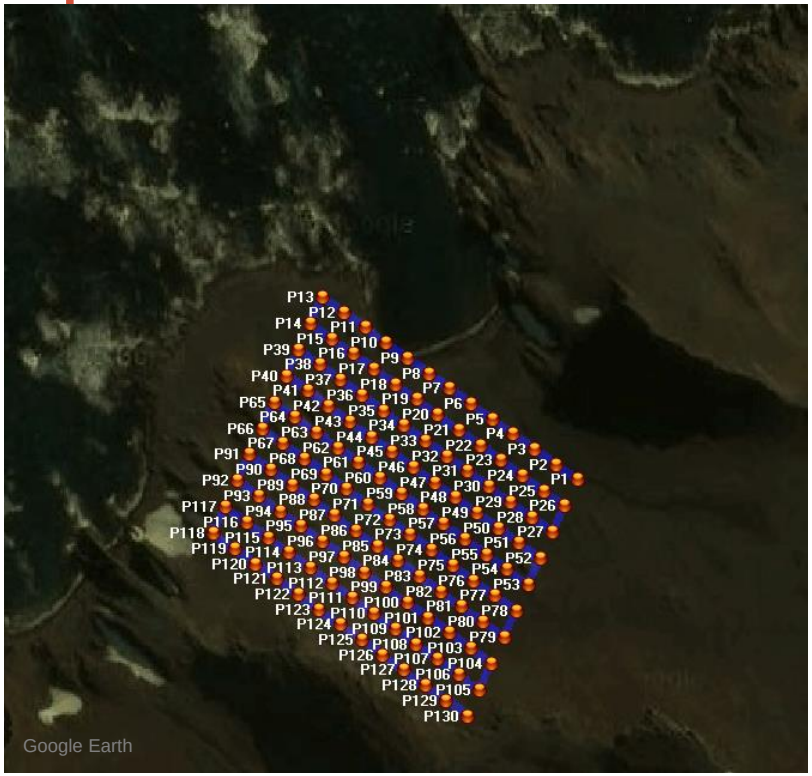
# Validation studies: Summary

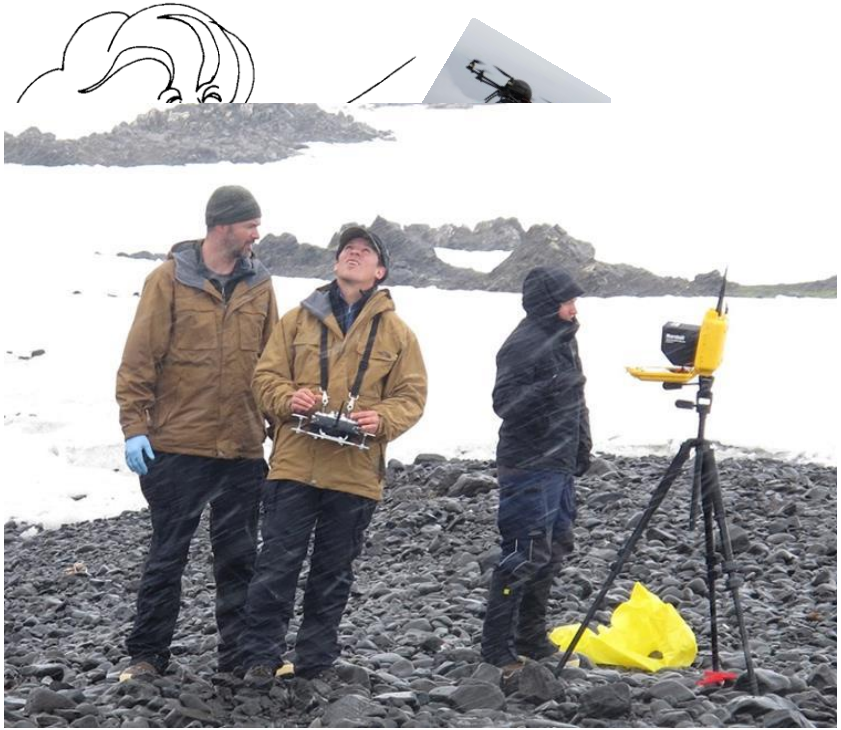



- Aerial surveys meet needs
- Error for chick census
  - 5% for chinstrap penguins
  - 10% for gentoo penguins
- Mission improvements?

1:1 line  Model fit  Confidence interval

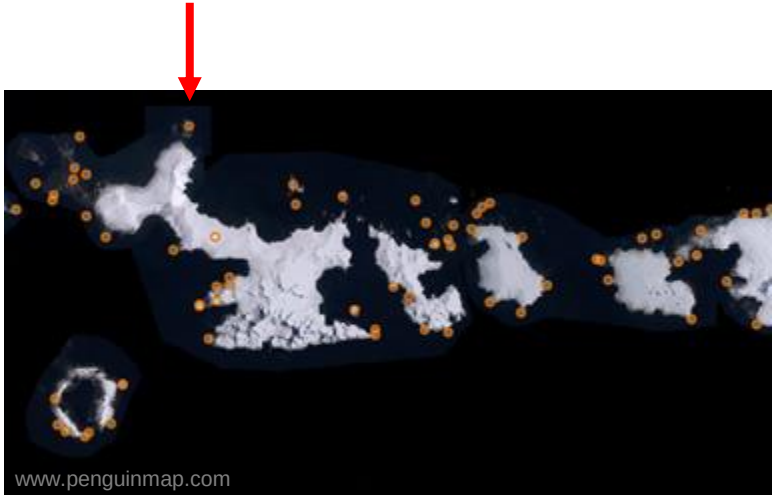
# Mission improvements: waypoints, gimbals, and experience



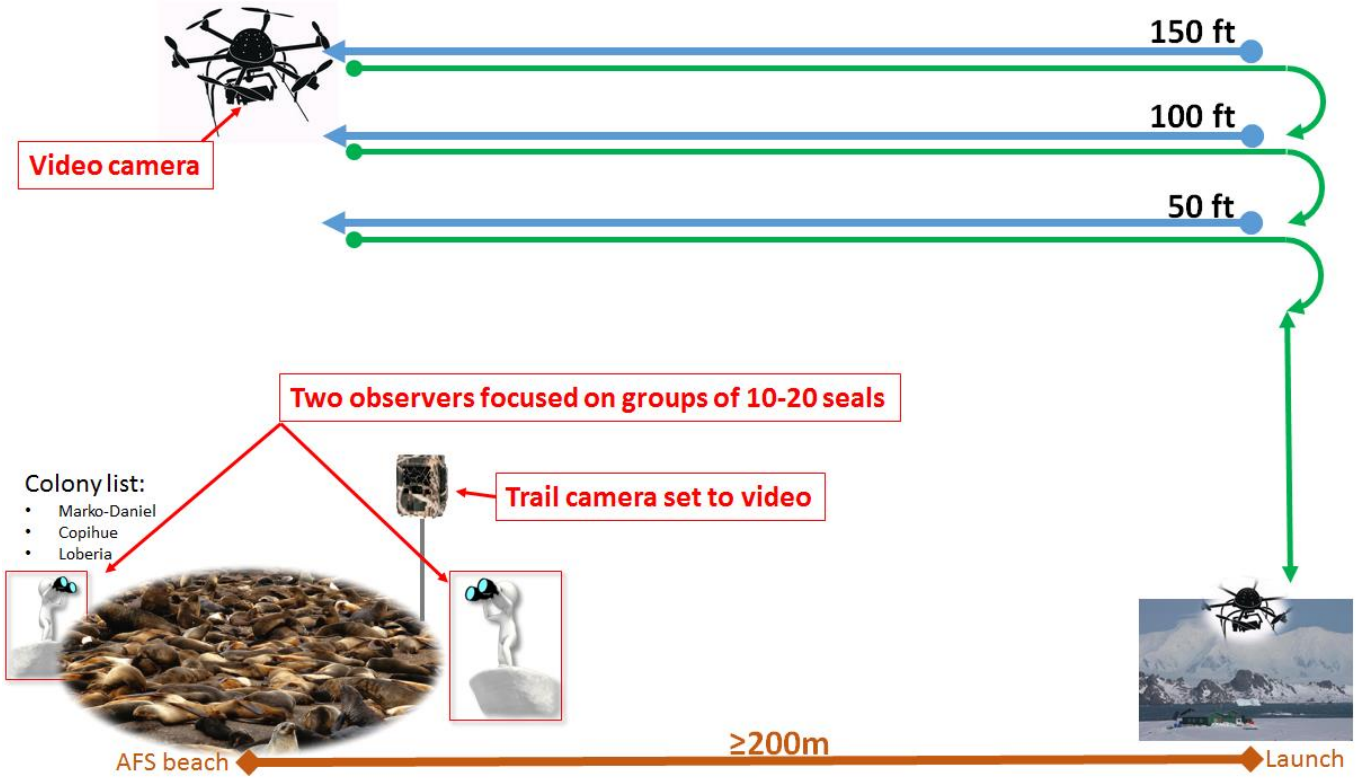
# Beyond our field camps

Cape Shirreff




- Numerous breeding sites throughout the area
- Opportunistic sampling possible
- Endurance and ship-based operations key

# Assessing disturbance



# THANKS

Photo credit:
J Hinke/NOAA